

COMPONENTS

FAQ

Q What is meant by a unified shader?

A Until recently, graphics cards were developed with dedicated pixel and vertex shaders that were accessed independently. For DirectX 10 compatibility, new graphics cards have a unified shader architecture, which incorporates both pixel and vertex shaders. These are accessed using a unified shader model, also known as Shader Model 4.0.

This makes it easier for programmers to write games, as they only have to learn one set of instructions, and makes the hardware more flexible. For outside scenes, most unified shaders on graphics cards can be set to generate vertices so there's lots of objects; indoors, unified shaders can be set as pixel shaders to create realistic rooms. DirectX 10 games should, in theory, run faster and look better than DirectX 9 games.

Nvidia's unified architecture uses the company's stream processors, while ATI uses its stream processing units.

David Ludlow
Deputy Editor



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ASUS P5K Deluxe/WiFi-AP

★★★★★

£142 inc VAT



Asus's MB P5K Deluxe/WiFi-AP motherboard is the first board we've seen to use Intel's P35 chipset. This chipset, codenamed Bearlake, has been designed to support Intel's latest range of Core 2 Duo processors with a frontside bus (FSB) speed of 1,333MHz. The processors' model numbers will end in 50, such as the E6650. Gigabyte's GA-965P-DSP (Rev 3.3) also supports these faster throughputs, but it's a tweak to the older P965 chipset.

The P5K Deluxe/WiFi-AP has four DDR2 RAM slots, which can take DDR2 800MHz memory. However, Asus also sells a DDR3 version of the board (P5K3 Deluxe/WiFi-AP), which can take 1,066MHz memory. DDR3 is still expensive and hard to come by, though, and early tests have shown that it's currently not significantly quicker than DDR2.

If you're into tweaking then you'll be happy with the P5K's BIOS settings. As well as some predefined settings that give a set percentage overclock, there's complete manual tuning. The FSB can be tuned from 200MHz (800MHz quad-pumped for the processor) up to 800MHz (2.4GHz quad pumped) in 1MHz steps. Memory is similarly easy to tweak and can be tuned from 667MHz up to 1,333MHz in 1MHz increments.

The big advantage of having a motherboard that's designed to run with an FSB of 1,333MHz is that you can use it to overclock the current range of 1,066MHz processors and you'll know that the motherboard is going to remain stable. Should you run into any problems, Asus's CPU Parameter Recall option lets you reset your settings and get your PC back to a stable state. Despite the motherboard's potential for overclocking, it is still passively



cooled by a series of heatsinks linked by a heat-pipe, so it's silent.

The P5K is one of the most feature-packed boards that we've seen, with six USB2 ports at the rear and headers for a further four. It's also one of the few motherboards we've seen to have built-in wireless in addition to dual Gigabit Ethernet ports. The 802.11g plug-in module has a removable antenna and can also be used as a wireless access point using Asus's software.

The P5K supports CrossFire, so you can run two ATI graphics cards together. Only the primary PCI-E x16 slot runs at full speed, though, and the secondary slot runs at x4 speed. Plugging in two double-slot cards will block all but one PCI slot, although you'll still leave the two PCI-E x1 slots free for expansion cards.

The P5K isn't cheap, but its range of features and overclocking options make it a good choice for anyone looking to build a powerful PC and use the latest processors. If you are holding out for DDR3 memory, though, we'd wait a couple of months for those prices to fall and then choose the P5K3 board instead. Those on a tighter budget who are looking for 1,333MHz processor support should go for Gigabyte's GA-965P-DS3P (Rev 3.3) instead; see 'Also consider...', below.

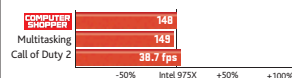
David Ludlow

SUMMARY

- ✓ Excellent overclocking options
- ✓ Lots of ports
- ✗ Expensive

INTEL MOTHERBOARD Intel P35 chipset, supports socket LGA775 processors, three PCI, two PCI-E x1, two PCI-E x16, four DIMM slots, two Gigabit Ethernet, six USB2, FireWire, 802.11g wireless adaptor
PART CODE P5K Deluxe/WiFi-AP
SUPPLIER www.scan.co.uk
DETAILS http://uk.asus.com

PERFORMANCE (see page 58)



Also consider...

INTEL Core 2 Duo E6700

★★★★★

£194 inc VAT

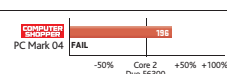
PRICE CUT!



Intel's new processor is based on the company's mobile technology. It is designed to be much more efficient than the P4. It's incredibly quick, achieving some of the highest benchmark results we've ever seen. You'll need a new Intel 965 or 975-based motherboard to use the E6700, but it's worth every penny, as it's by far the best-value processor you can buy.



PROCESSOR Two cores running at 2.66GHz, LGA775, 267MHz external bus, 4MB L2 cache
PART CODE BX805576700
SUPPLIER www.ebuyer.com
DETAILS www.intel.com
✓ Extremely fast; great value
FULL REVIEW Oct 2006



GIGABYTE GA-965P-DS3P (Rev 3.3)

★★★★★

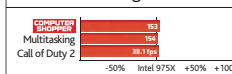
£77 inc VAT



This motherboard uses Intel's P965 chipset, but it's been modified to take processors with a 1,333MHz frontside bus. It uses solid-state capacitors, so should be more reliable than those that use fluid-electrolyte ones. Performance was excellent, and there's even support for CrossFire. It's a great board at a great price.



INTEL MOTHERBOARD P965 chipset, supports socket LGA775 processors, two PCI, two PCI-E x1, two PCI-E x16, four DIMM slots, Gigabit Ethernet, four USB2, FireWire
PART CODE GA-965P-DS3P
SUPPLIER www.scan.co.uk
DETAILS www.gigabyte.com.tw
✓ Excellent performance; supports 1,333MHz frontside bus processor
FULL REVIEW Aug 2007



GIGABYTE GA-MA69G-S3H

★★★★★

£58 inc VAT

We've seen AMD's 690G motherboard chipset before, but Gigabyte's GA-MA69G-S3H is the first ATX board we've seen to use it. This gives more room for expansion ports over the microATX boards we've reviewed, but retains everything we like about the chipset for use in a media centre, including the HDMI output. There's also a standard VGA output, so you can run two monitors without having to buy a dedicated graphics card.

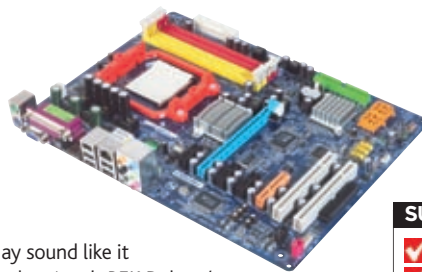
If you want to upgrade to a full graphics card, there's a PCI-E x16 slot for this job. There's plenty of room for other expansion cards, though, with four PCI-E x1, one PCI-E x4 and two PCI expansion slots. The PCI-E x4 slot can also be used for a second full-size graphics card (part of the graphics card's connector will remain unconnected) and let you run in CrossFire

mode. This may sound like it would be slow, but Asus's P5K Deluxe/WiFi-AP (reviewed opposite) has a second PCI-E x16 slot that only runs at x4 speed.

There's plenty of room for storage on the GA-MA69G-S3H, with four SATA2 ports that can be used in a RAID configuration. Four USB2 ports, Gigabit Ethernet and FireWire ensure that connecting to external devices is no problem, either.

If you're looking to build a budget PC or a media centre in a case that will take an ATX motherboard, the GA-MA69G-S3H is a good choice with plenty of expansion options. If you don't need all the slots and ports, though, MSI's K9AGM2 is a better choice; see 'Also consider...', below.

David Ludlow



SUMMARY

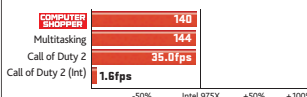
- ✓ HDMI output
- ✓ Lots of expansion slots
- ✗ Pricier than microATX 690G boards

AMD MOTHERBOARD AMD 690G chipset, supports AMD Socket AM2 processors, two PCI, one PCI-E x16, one PCI-E x4, three PCI-E x1, four DIMM slots, four USB2, FireWire, HDMI, D-sub

PART CODE GA-MA69-S3H

SUPPLIER www.dabs.comDETAILS www.gigabyte.com.tw

PERFORMANCE (see page 58)



INTEL Core 2 Duo E6320

★★★★★

£103 inc VAT



Intel's Core 2 Duo E6320 is the successor to the excellent Core 2 Duo E6300, which we awarded a Best Buy in *Labs, Shopper* December 2006. The E6300 has now been withdrawn from sale, although at the time of writing PC World (www.pcworld.co.uk) was still selling them for £100.

The changes between the two processors are minimal. The E6320 has the same quad-pumped 1,066MHz FSB, 1.86GHz clock speed and two 64KB level 1 caches as the E6300. The E6320 also uses the same 65nm fabrication process. In fact, the only difference is that the E6320 has 4MB of level 2 cache compared to the E6300's 2MB. This should make the

E6320 a little bit quicker, particularly at memory operations.

Our tests showed this to be correct. Testing on Asus's P5K Deluxe/WiFi-AP motherboard (reviewed opposite), we got marginally quicker results from the E6320 than we did from the E6300. The extra couple of points in all of our tests aren't much to get excited about, and there's no point in buying an E6320 if you've already got an E6300.

That said, if you're looking to build a new PC, the E6320 is an excellent-value, speedy processor and great for a budget computer.

David Ludlow



SUMMARY

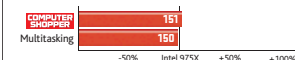
- ✓ Good performance
- ✓ Good value
- ✗ Not much faster than the E6300

PROCESSOR Two cores running at 1.86GHz, LGA775, 266MHz external bus, 4MB L2 cache

PART CODE BX80557E6320

SUPPLIER www.advantec.co.ukDETAILS www.intel.com

PERFORMANCE (see page 58)



MSI K9AGM2

★★★★★

£37 inc VAT



MSI's K9AGM2 is the best-value motherboard if you want to build a media centre PC. It's a microATX board,

so it will fit in a suitably attractive and small case. It's also got all the outputs that you'll need built in, including an HDMI output for connecting to an LCD TV. Its performance was very good. This motherboard is an absolute bargain.



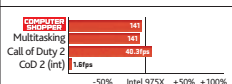
AMD MOTHERBOARD AMD 690G chipset, supports AMD Socket AM2 processors, one PCI slot, one PCI-E x1 slot, one PCI-E x16 slot, two DIMM slots, one Gigabit Ethernet, four USB2 ports, HDMI PART CODE K9AGM2 SUPPLIER www.lambda-tek.com

DETAILS www.msi.com.tw

✓ Excellent value; HDMI output

✗ Only two memory slots

FULL REVIEW Jul 2007



SHUTTLE XPC SD32G2

★★★★★

£200 inc VAT



The SD32G2 looks smart, but you'll need an optical drive with a silver bezel to

avoid spoiling its looks. It's easy to build thanks to the detailed instructions. Performance was excellent in our 2D tests, near the top of the recent Labs test. With support for Core 2 Duo processors, it's an excellent barebones kit.

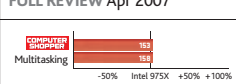


BAREBONES PC LGA775 processor socket, two DDR2 533/667 DIMM slots, Intel 945G graphics, one PCI-E x16, two SATA ports, 10/100/1,000 network, six USB2, two FireWire, 7.1 audio, one 5¼in bays, two 3½in bays PART CODE SD32G2 SUPPLIER www.ebuyer.com

DETAILS www.shuttle.com

✓ Plenty of room inside case; easy to assemble

FULL REVIEW Apr 2007



ECS N8800GTS-320MX

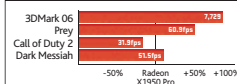
★★★★★

£182 inc VAT



ECS's N8800GTS-320MX has half the memory of other GeForce 8800GTS graphics cards we've reviewed, but it is much cheaper. Fortunately, the performance isn't affected, and we managed to get excellent results from all our games.

GRAPHICS CARD Nvidia GeForce 8800 GTS, 500MHz core speed, 96 stream processors running at 1.2GHz, 320MB GDDR3 memory running at 800MHz (1.6GHz effective), PCI-E x16, two DVI, TV-out PART CODE N8800GTS-320MX SUPPLIER www.dabs.com DETAILS www.ecs.com.tw ✓ Good value; very fast ✗ Vista drivers can be unreliable FULL REVIEW Jul 2007



POWERCOLOR HD 2900XT

★★★★★

£242 inc VAT

Nvidia has managed to keep the graphics card lead from ATI for some time now, with its DirectX 10-compatible 8000 series of cards. With PowerColor's HD 2900XT, it's time for ATI to strike back. As the card's name suggests, it uses ATI's Radeon HD 2900XT chip. Like Nvidia's latest graphics chips, it's DirectX 10-compatible.

The HD 2900XT has a very similar price and performance to 640MB GeForce 8800GTS-based graphics cards. ATI currently doesn't have a high-end version of its new graphics chip to compete with Nvidia's GeForce 8800GTX, although it will have lower-end 2400 and 2600 chips available soon.

ATI has implemented a similar style of architecture to Nvidia's, ditching traditional pixel-pipelines for a new unified architecture. In this case, ATI uses stream processing units (SPUs) and the HD 2900XT has 320 of them, compared to the 8800GTS's 96 stream processors.

While this would appear to be a clear advantage on ATI's behalf, it's actually a lot more complicated than that, because the architecture used by the two companies is completely different. Inside the HD 2900XT, the SPUs are put together into unified shader units (see FAQ, page 42). With five SPUs per shader unit – four normal ones, plus one that handles mathematically complex transcendental functions – ATI's graphics chip has 64 unified shaders; Nvidia's architecture means that each stream processor is a unified shader, so the 8800GTS has more unified shaders than the HD 2900XT. This would seem to turn things around in Nvidia's favour.

However, things get even more complicated when you look further. Each of Nvidia's shaders is capable of handling one instruction per clock cycle; ATI's architecture makes it possible to handle up to six instructions per clock cycle. There can be a slight trade off, though, as Nvidia's simple architecture makes it easy to keep each stream processor busy, while ATI's more complicated architecture makes it harder to keep each shader unit busy and has to employ complicated load balancing to do so.



It's just as hard to simply compare memory speeds. The HD 2900XT has 512MB of GDDR3 memory running at 825MHz (1.65GHz effective), while the 8800GTS has 640MB of GDDR3 memory running at 800MHz (1.6GHz effective). However, ATI's graphics chip has a much wider 512bit memory interface, so bandwidth is a lot higher and it can shift data faster. This is slightly tempered by the fact that the HD 2900XT has just 16 render output units (one of the final stages in the graphics pipeline), while the 8800GTS has 20. The result is a slight bottleneck in ATI's architecture.

We had to look to performance to find out which one is better. We had real trouble picking a clear winner when comparing the HD 2900XT with an 8800GTS. In our Call of Duty 2 and Dark Messiah tests, the 8800GTS came out as the slight winner. With Prey and 3DMark06, the HD 2900XT was in front. The Prey test is of particular interest, as this game uses OpenGL and ATI's cards have historically struggled with this. The 2900XT's performance at 1,600x1,200 was excellent across all our games, with Prey running at an amazing 62.9fps and Call of Duty at a very playable 42.9fps.

Games performance isn't everything, though, and the 2900XT is also designed to be good for home entertainment. In particular, the card has HD audio on it, so using the DVI-to-HDMI dongle in the box means you can output video and audio to a suitable source, such as a TV. This works only with the supplied ATI dongle, though, and not regular DVI-to-HDMI dongles or cables.

Sadly, the HD 2900XT doesn't have support for ATI's Universal Video Decode (UVD) technology, which was designed to offload video decoding from the processor to the graphics card, producing smoother playback and stressing the system less. The lower-price 2400 and 2600-based cards will have this technology, though.

If money is no object for you, Nvidia's 8800GTX remains the best card. Otherwise, it's incredibly difficult to pick between the HD 2900XT and an 8800GTS-based card. If you want to run CrossFire then the 2900XT is the best choice, but SLI motherboard owners should choose the 8800GTS. If you're looking to build a standalone system then either card is a good choice, although the 2900XT's HDMI output makes it a marginally better choice if you want it for a media PC. Those on a tighter budget should opt for ECS's N8800GTS-320MX; see 'Also consider...' on page 43.

In next month's Labs, we'll be reviewing a wide range of graphics cards, so if you can't choose what you want now then hopefully that will help.

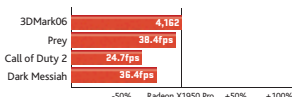
David Ludlow

SUMMARY

- ✓ Fast graphics
- ✓ Good value
- ✗ No Universal Video Decode

GRAPHICS CARD ATI Radeon HD 2900XT, 740MHz core speed, 512MB GDDR3 memory running at 825MHz (1.65GHz effective), PCI-E x16, two DVI, TV-out, DVI-to-HDMI adaptor
PART CODE R60C-TVE3
SUPPLIER www.scan.co.uk
DETAILS www.powercolor.com

PERFORMANCE (see page 58)



CHOOSING A... Processor

Follow the steps to find your ideal specs

MANUFACTURER: AMD

PROCESSOR: Sempron 3000+

SOCKET: AM2

Recommended minimum in grey

1 A processor with the minimum specifications above costs around £35. It's not particularly quick and is best suited to standard office applications. As it uses the latest Socket AM2 interface, you'll need a new motherboard to match, but you'll be able to upgrade to any of AMD's newer processors.

2 If you're upgrading only your processor, you'll be limited by your motherboard's socket type. AMD Socket 754 boards provide the least choice, with an Athlon 64 3400+ the fastest processor you can buy. Socket 939 motherboards provide more options, including dual-core X2 processors and going as fast as the FX-60. Socket AM2 is the latest, supporting AMD's full range.

Intel's LGA775 socket has been around for a few years, but check your motherboard's manual for processor support as only the latest chipsets support Intel's Core 2 Duo processors.

3 If you're building a PC from scratch, it's best to pick the processor first and choose a motherboard to match. If you're building a basic office PC, a single-core Intel Celeron or AMD Sempron is fine. If you do a lot of intensive tasks, a dual-core AMD X2 or Intel Core 2 Duo processor is a better choice.

The Core 2 Duo range is our current favourite. The E6320 (around £100) is a good entry-level choice, while the E6700 (around £195) is very quick. If your motherboard doesn't support Core 2 Duo, the Pentium D range of dual-core processors is still quick. The old single-core Pentium 4s and Athlon 64s are no longer good value and we'd avoid them unless your motherboard doesn't support dual-core.

4 Want to overclock? Intel's Extreme processors and AMD's FX processors are multiplier-unlocked, so you can adjust their speeds without affecting your memory or other components. However, the Core 2 Extreme X6800 costs around £600.

5 You can buy Intel's mobile Core 2 Duo and Core Duo processors, too. However, you'll need a motherboard or barebones PC compatible with Socket 479. Mobile processors are more expensive, so buy one only if you need to.